



Mobile Codes Architecture

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1. Scope

(Informative)

OMA Mobile Codes Enabler aims to stimulate, by the creation of a standard, a global market in which barcodes act as enablers for camera-equipped devices* to access content and services. Some technologies already exist; for example, in Japan, 2D barcode scanning is in widespread use. However there is fragmentation in the worldwide market currently, due to the variety of approaches to the questions of which barcode symbologies should be supported, what format of data they should contain, and how client software should behave when barcodes are read. The Open Mobile Alliance aims to halt fragmentation by creating specifications to address interoperability needs as they arise. Once enough Mobile Code Clients that follow those specifications are deployed on mobile devices, marketing organisations and publishers will be able to include Mobile Codes as links to online content and services with confidence, in advertising and promotional campaigns, and in printed and displayed media of many kinds.

*Note: Devices for the Mobile Codes Enabler are intended to be handheld mobile devices (i.e. handsets, PDAs, etc.) used by a human person.

2. References

2.1 Normative References

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- [URI] “RFC 3986. Uniform Resource Identifier (URI): Generic Syntax”, IETF, <http://www.ietf.org/rfc/rfc3986.txt>.

3. Terminology and Conventions

3.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

3.2 Definitions

Code Clearing House function	The process of Indirect Code routing based on the Indirect Code Identifier, through which: a) the Resolving CMP is determined, and b) the Indirect Code Identifier is forwarded to the Resolving CMP.
Code Management Platform	The Code Management Platform provides a resolution service pertaining to Indirect Codes; it is normally capable of performing both the Code Clearing House function and Code Resolution and may also interact with other Code Management Platforms, as required. In certain deployment scenarios, the CCH function and the CR function may be implemented in two separate Code Management platforms. (See Split-CMP-Parent and Split-CMP-Child).
Code Resolution (or Code Resolution function)	The process of mapping a Direct Code or an Indirect Code into either content to be consumed directly by the device, or the address of content (or a service) to be accessed by the device. Typically, Code Resolution for Indirect Codes requires access to network service.
Code Transfer	The ability for a Code Publisher to change the Resolving CMP for a single or multiple Indirect Code Identifiers.
Routing Prefix	That part of the Indirect Code Identifier that contains a value that is uniquely assigned to the CMP (Split-CMP-Child, as applicable) and is used for routing.
Direct Code	A Mobile Code that contains either: (a) content for direct consumption by the device, or (b) the address of content (or a service) to be accessed (typically, a URI [URI]).
Global Mobile Code Registry	A service concept of a single entity entrusted by a pertinent global industry association (such as, the GSM Association, GS1, etc. with presumed endorsement by the majority of stakeholders in the nascent Indirect Code ecosystem) to perform mobile code registry services with a global scope. To date, the GMCR service concept has not materialised, but remains a relevant concept for potential future reference.
Home CMP	The CMP to which a particular MCC is configured to send all Code Resolution requests. Where applicable in a Split-CMP deployment scenario, the Home CMP may be a Split-CMP-Parent.
Indirect Code	A Mobile Code that contains an Indirect Code Identifier.
Indirect Code Identifier	An identifier in the Indirect Code that has to be resolved in order to access the intended content or service. See also Code Resolution.
Mobile Code	A 1D or 2D barcode as read by camera-equipped devices.
Mobile Code Client	The MC Enabler software entity that resides in the device, and contains the functionality to acquire, decode, and extract the encoded information for further processing as required. This is often referred to as a Mobile Code Reader and these terms can be used synonymously.
Mobile Code Data Format	The syntactical description of the information contained within a Mobile Code.
Mobile Code Publisher	This is a brand (business, organisation or individual) who distributes certain content or services (i.e. an advertising campaign) to a mass audience by using Mobile Code Scanning as a channel.
Mobile Code Registry	A local registry responsible for sub-allocation of Mobile Code Routing Prefixes within the ranges of Routing Prefixes obtained from OMNA. The MCR also supports a data look-up facility accessible by authorised principals (e.g. CMPs or Split-CMP-Parents) for Routing Prefixes in its database.
Mobile Code Scanning	The physical act of capturing a Mobile Code Symbology and decoding the information contained within the Mobile Code.
Mobile Code Service	A set of Policy Conditions [OMADICT] that convey any service level constraints that are placed on

Policy	Mobile Code Resolution. Mobile Code Service Policy is typically defined by the Mobile Code Publisher and is applicable to one or more Indirect Code Identifiers.
Multi-lateral Arrangement	An arrangement amongst specific CMPs (including Split-CMP-Parents, where applicable) that are not associated with any Mobile Code Registry, in which the parties agreed to support each other in a multi-lateral way in order to manage sub-allocation of MC Routing Prefixes as well as discovery and updates thereof; details of such MLAs are not specified in the MC Enabler TS.
Remote CMP	The CMP that receives a Code Resolution request when the Home CMP (or Split-CMP-Parent, where applicable) is unable to resolve a particular Indirect Code Identifier.
Resolution Identifier	That part of the Indirect Code Identifier that is used to index the content or service.
Resolving CMP	The CMP (or Split-CMP-Child, where applicable) that is able to resolve a particular Indirect Code Identifier.
Split-CMP-Child	A CMP in the Split-CMP deployment scenario, where only the Code Resolution function is implemented. In addition, subject to business relationship, a Split-CMP-Child may be associated with one and only one Split-CMP-Parent.
Split-CMP-Parent	A CMP in the Split-CMP deployment scenario, where only the Code Clearing House function is implemented. In addition, subject to business relationship, a Split-CMP-Parent may be associated with multiple Split-CMP-Children.
Symbology	The algorithm by which data is encoded as visual elements (typically arrangements of lines or squares), and the resultant “look and feel” for the user.

3.3 Abbreviations




1D	1-Dimensional
2D	2-Dimensional
CCH	Code Clearing House
CMP	Code Management Platform
CR	Code Resolution
EAN	European Article Number, see EAN/UPC
EAN/UPC	Barcode symbology family including EAN-8, EAN-13, UPC-A, and UPC-E [EAN/UPC]
GMCR	Global Mobile Code Registry
ICI	Indirect Code Identifier
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
MC	Mobile Code
MCC	Mobile Code Client
MCP	Mobile Code Publisher
MCR	Mobile Code Registry
OMA	Open Mobile Alliance
OMNA	Open Mobile Naming Authority
QR	Quick Response, a type of barcode symbology [QR]
SMS	Short Message Service
UPC	Universal Product Code, see EAN/UPC
URI	Uniform Resource Identifier [URI]

4. Introduction

(Informative)

Mobile Codes – 2D and 1D barcodes – have emerged as a promising enabler of the mobile Internet in some markets. Camera-equipped devices now have good enough optics, image resolution and processing capacity to read Mobile Codes on printed materials and electronic displays. These symbols encode information such as URLs, phone numbers, and in-line content such as business cards.

There is, however, still a lack of interoperability between different markets and players. The majority of consumers are unlikely to adopt the technology before it comes pre-installed on their devices. Similarly, marketing, publishing and other industries that are otherwise motivated to provide Mobile Codes will not adopt them without adequate potential for consumer take-up. That in turn would entail deployment on a large variety of devices, and interoperability between different service providers.

Example			 5 901234 123457 >
Symbology	QR [QR]	Data Matrix [DATAMATRIX]	EAN-13 [EAN/UPC]
Data	http://www.openmobilealliance.org	http://www.openmobilealliance.org	5901234123457

4.1 Version 1.0

The Mobile Codes Enabler contains support for a full ecosystem for both Direct and Indirect Codes.

Technology is specified for:

- Symbology(ies)
- Mobile Code Data Format
- Direct encoding of content
- Encoding of Indirect Code Identifiers
- Resolution of Indirect Code Identifiers
- Security procedures

5. Architectural Model

The MC Enabler AD is realized using a client-server concept. The architecture is designed to provide resolution of Indirect Codes and to support services based on the MC Enabler.

The architecture is based on the requirements defined in [MC-RD].

5.1 Dependencies

The MC Enabler depends upon other OMA Enablers and specifications from other bodies, including the following:

- ISO QR Code [QR] that provides one of the symbologies typically used with Mobile Codes.
- ISO Data Matrix Codes [DATAMATRIX] that provides one of the symbologies typically used with Mobile Codes.
- OMA URI [OMAURI] that provides the URI schemes intended to be used with Mobile Codes.

In addition, all interactions between components described in the Mobile Code Enabler architecture assume the existence of relevant and current business relationships governing the affected components, as applicable (e.g. between the MCC, CMP, Split-CMPs), details of which are out-of-scope of the enabler.

5.2 Architectural Diagram

5.2.1 Architectural Model (Normative)

Mobile Codes Enabler defined an architectural model that can be instantiated to accommodate different market scenarios as motivated by distinct business models [Ref: MC-RD].

In the normative architecture, the Code Management Platform (CMP) component performs the two primary functions: Code Clearing House (CCH) function and Code Resolution (CR) function. This scenario reflects the case where both of these functions are owned & operated by the same actor. In case the CCH function and CR function are owned & operated by different actors, a split-CMP deployment scenario can also be supported. Further details of possible deployment scenarios, functional components and interfaces are provided in Sections 5.2.2, 5.2.3 and 5.3.

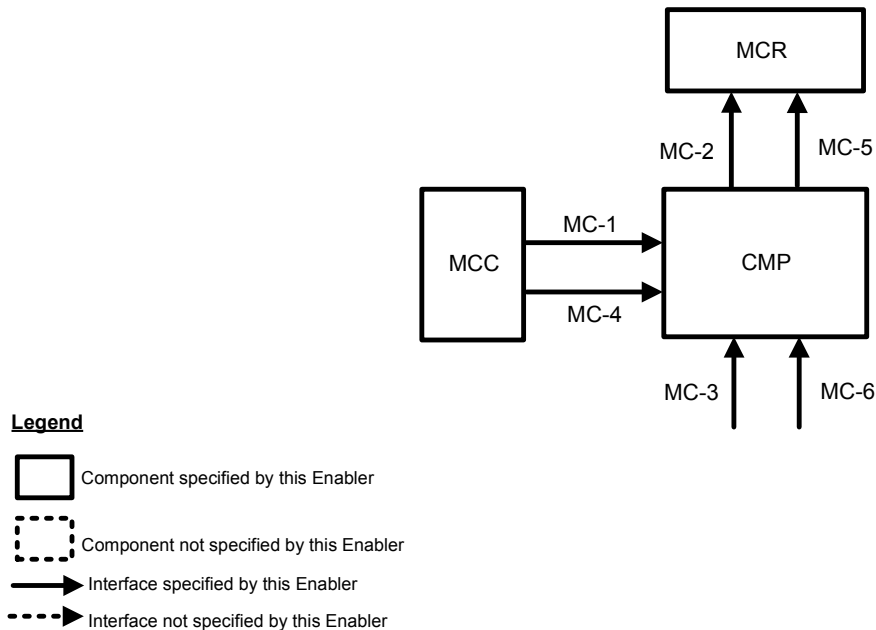


Figure 1: MC Architecture Model

NOTES:

1. Mobile Code Registry (MCR) and its exposed interfaces MC-2 and MC-5 are optional. Alternatively, if CMP belongs to a multi-lateral arrangement (MLA) with other CMPs, equivalent functionalities to the MCR can be achieved; details of MLAs are not specified in this enabler.
2. Interfaces MC-3 and MC-6 are exposed to another CMP only when the CMP in question is acting as a Remote CMP.

5.2.2 Deployment Scenarios (Informative)

Instantiating the MC architecture from 5.2.1, two deployment scenarios are illustrated in this section. Some terms used herein are also informative relevant to the deployment scenarios as described. “Home CMP” and “Remote CMP” are instantiated roles pertinent only to the resolution of a given Indirect Code. As explained further in Section 5.3.2 the MCR, where one is implemented with associated CMPs, provides a real-time data query function for discovery of unknown Routing Prefixes pertaining to a given Indirect Code; hence, CMP communications with the MCR is on an as-required basis. Equivalent MCR functions may also be fulfilled by a MLA, where one exists.

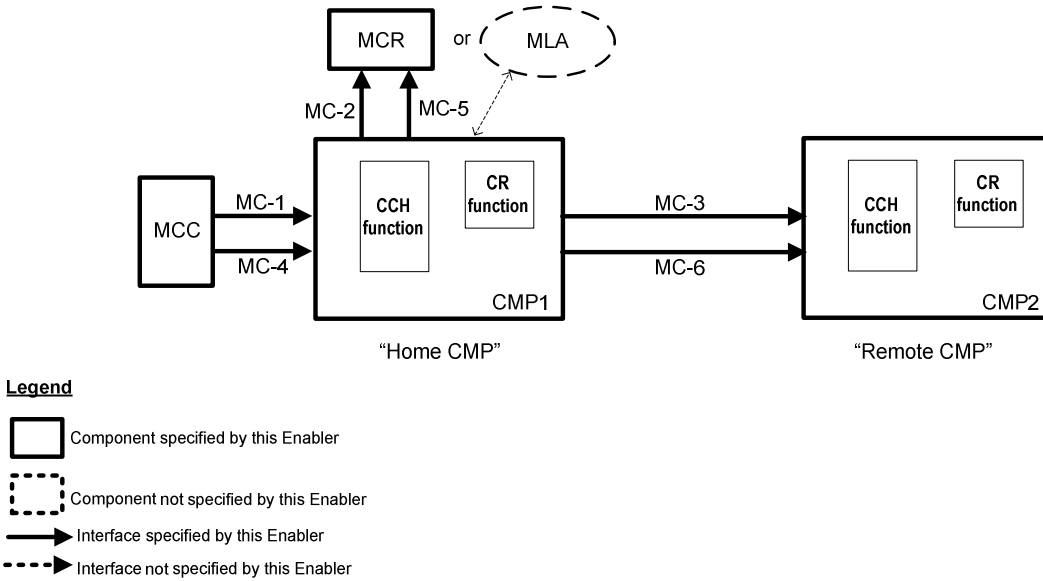


Figure 2: Deployment Scenario 1: Home CMP interconnecting with a Remote CMP

In Figure 2, two CMPs are involved in resolution of a given Indirect Code. In this instance, CMP1 acts as the Home CMP and CMP2 acts as the Remote CMP; the CR function in the Remote CMP resolves the Indirect Code. CMP2 in this instance is also called the “Resolving CMP”.

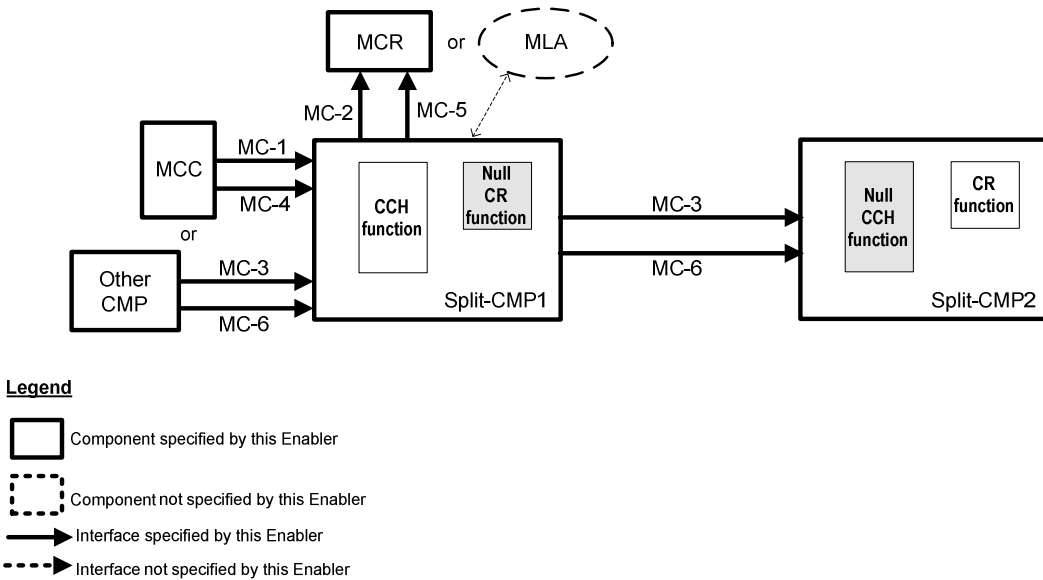


Figure 3: Deployment Scenario 2: Split-CMP Interconnection

In Figure 3, a Split-CMP scenario relevant in some market is shown. Split-CMP1 acts as a “clearing house” entity implementing only the CCH function; Split-CMP2 acts as a “campaign manager” entity implementing only the CR function. In this instance, the CR function in the Split-CMP2 resolves the Indirect Code; hence Split-CMP2 is also the “Resolving

CMP". Subject to implementation, specific business relationship may also constrain the interconnection of multiple campaign managers to the same clearing house, which is analogous to the child(ren) to parent relationship.

5.2.3 Interface Definitions – General (normative)

This section lists general definitions of the interfaces specified in the Mobile Code Enabler architecture. Note that message flow is not restricted by the direction of the interface exposure; i.e., messages may flow one way or the other, or both, depending on the functionality specified (see Section 5.3 for details of functional components and interfaces). Use of the MCR is described herein normatively, albeit its implementation is optional (see Note 1 of Figure 1).

- MC-1 (mandatory): This interface is exposed by the Home CMP to an authorised principal (e.g. the MCC) for transfer of *latency-critical* information; this information may include: request for resolution of Indirect Code Identifier, response containing resolved content or address of content (or a service), error codes, additional meta-data (e.g. subscriber profile information and location information).

Note: Transfer of *latency-critical* information refers to transactions or messaging flows specified by the MC Enabler that directly impact on the user experience due to sensitivity to latency. Such message flows normally start from the MCC decoding of the data of an Indirect Code ending with its successful resolution by the Resolving CMP and return of the Code Resolution results to the MCC for action. However, additional message flows with increased latency might result when the Home CMP needs to query the MCR about unknown Mobile Codes before forwarding the Code Resolution requests to the Resolving CMP.

- MC-2 (optional, applicable to an MCR having associated CMPs): This interface is exposed by the MCR to an authorised principal (e.g. the CMP) for transfer of *latency-critical* information; this information includes: query & response for network address of the Resolving CMP.
- MC-3 (mandatory): This interface is exposed by the Remote CMP to an authorised principal (e.g. the Home CMP) for transfer of *latency-critical* information; this information may include: request for resolution of Indirect Code Identifier, response containing resolved content or address of content (or a service), error codes, additional meta-data (e.g. subscriber profile information and location information).
- MC-4 (mandatory): This interface is exposed by the Home CMP to an authorised principal (e.g. the MCC) for transfer of *non latency-critical* information; this information may include: tracking and logging, accounting and reporting, etc.

Note: Transfer of *non latency-critical* information refers to all transactions or messaging flows specified by the MC Enabler that are excluded from the transfer of *latency-critical* information as mentioned above.

- MC-5 (optional, applicable to an MCR having associated CMPs): This interface is exposed by the MCR to an authorised principal (e.g. the CMP) for transfer of *non latency-critical* information; this information includes: the right to use a Routing Prefix, the associated network address of the Resolving CMP, and information necessary to handle code transfer and updates on the Routing Prefixes and/or transferred ICIs.
- MC-6 (mandatory): This interface is exposed by the Remote CMP to an authorised principal (e.g. the Home CMP) for transfer of *non latency-critical* information; this information may include: reporting, chargeable events, updates on the Routing Prefixes and/or transferred ICIs through Multi-lateral Arrangements among the CMPs, etc.

5.3 Functional Components and Interface Definitions - Detailed

5.3.1 Mobile Code Client (MCC)

The MCC component supports the following functions:

1. 1D Mobile Code decoding function: When this function is supported, decode EAN/UPC family of 1D Mobile Codes.
2. 2D Mobile Code decoding function:

- a) Decode 2D Mobile Codes that are encoded in accordance with the MC Enabler supported symbology(ies).
 - b) Retrieve the Mobile Code information in accordance with the MC Enabler supported Mobile Code Data Format.
 - c) Differentiate Direct Codes from Indirect Codes.
3. Indirect Code Identifier resolution request function: Request the CMP (or Split-CMP-Parent, where applicable) to resolve the Indirect Code Identifier.
4. Metadata forwarding function:
- a) Forward any metadata, as available, to CMP (or Split-CMP-Parent, where applicable) for processing.
 - b) Confirm end user consent before metadata is forwarded.
5. Network, service/content access function:
- a) Confirm end user consent before network access is initiated to prevent unintended network usage.
 - b) Invoke the appropriate application to consume the decoded or resolved content or the address of content (or a service), e.g., invoke a browser to consume a URL or transfer some contact content to an address book.
6. User personal data collection function (where permissible by applicable Regulations): When this function is supported,
- a) Prompt the end user to provide or update end user personal information.
 - b) Interact with appropriate enabler(s) to retrieve or update the end user personal information.
 - c) Shall make it possible for the end user to “opt-in” or “opt-out” of end user personal data collection.
7. Tracking and logging function (where permissible by applicable Regulations): When this function is supported, collect and report data on end user code scanning behaviours in collaboration with the device or the network.
8. Provisioning function:
- a) Receive requests for provisioning, configuration and/or update of parameters relevant to the MCC.
 - b) Process the above requests in accordance with applicable policies and security framework of the default CMP (or Split-CMP-Parent, where applicable).
 - c) Configure and update MCC scanning capability parameters subject to the capabilities and access privileges of the device where the MCC resides.
 - d) Configure and update the default CMP (or Split-CMP-Parent, where applicable) network address to which the Indirect Code Identifier is forwarded for resolution.
9. Error handling function:
- a) Receive error messages, as available, from the CMP (or Split-CMP-Parent, where applicable).
 - b) Process the error messages to notify the end user (e.g., the reason for failure to decode or resolve a Mobile Code).

The MCC uses the following interfaces to communicate with other entities in the Architecture Diagram:

- Interface MC-1 to communicate with the CMP (or Split-CMP-Parent, where applicable) for the purpose of:
 - a) Sending a resolution request to the CMP (or Split-CMP-Parent, where applicable) to resolve the Indirect Code Identifier.

- b) Receiving the resolution response from the CMP (or Split-CMP-Parent, where applicable).
- c) Receiving error messages, as available, from the network.
- Interface MC-4 to communicate with the CMP (or Split-CMP-Parent, where applicable) for the purpose of forwarding the tracking, logging, reporting and accounting data to the CMP (or Split-CMP-Parent, where applicable).

5.3.2 Mobile Code Registry (MCR)

The Mobile Code Registry (MCR) is an optional component comprising of a local registry responsible for sub-allocation of Mobile Code Routing Prefixes within the ranges of Routing Prefixes obtained from the Open Mobile Naming Authority (OMNA). The MCR also supports a data look-up facility accessible by authorised principals (e.g. CMPs or Split-CMP-Parent) for Routing Prefixes within its database.

Note: As an alternative to the MCR approach, Multi-lateral Arrangements ('MLAs') agreed amongst groups of CMPs (or Split-CMP-Parents, where applicable) can also effectively ensure the uniqueness of assigned Routing Prefixes and their discovery between the partners in a given MLA. It is envisaged that sub-allocation of ranges of Routing Prefixes within a MLA can be achieved by actions similar to those taken by a MCR, but the discovery of Routing Prefix assignments within the MLA may be achieved by other means than data look-up facility. Details of any MLA are out-of-scope of the MC Enabler.

The MCR component (when implemented) supports the following functions:

1. Routing Prefix assignment function: Using a range or ranges of Routing Prefixes allocated by the OMNA,
 - a) Ensure uniqueness of all the assigned Routing Prefixes within its assigned ranges of prefixes.
 - b) Assign one or more Routing Prefix(es) to its associated CMP (or Split-CMP-Parent, where applicable).

Note: Subject to business relationship in a specific deployment scenario, the MCR may assign Routing Prefixes directly to the Split-CMP-Child, but would require oversight and cooperation by its Split-CMP-Parent; such details are out-of-scope of this Enabler.
 - c) Maintain current in a Routing Prefix table the association between each assigned Routing Prefix with
 - Either the network address of the Resolving CMP;
 - Or the network address of the Split-CMP-Parent and identification information of the Resolving Split-CMP-Child.
2. Routing Prefix update function: Make the Routing Prefix table in 1(c) above and its updates available to its associated CMPs (or Split-CMP-Parents, where applicable).
3. Routing Prefix query processing function: Respond to queries from its associated CMPs (or Split-CMP-Parents, where applicable) on the associations based on the Routing Prefix table as in 1(c) above.
4. Code Transfer management function (optional): When this function is supported, assist in fulfilling Mobile Code Resolution responsibilities that have been transferred from one associated CMP (or Split-CMP-Child, where applicable) to another associated CMP (or Split-CMP-Child, where applicable) by performing the following actions:
 - a) Manage Code Transfer between involved CMPs (or Split-CMP-Children, where applicable).
 - b) Maintain for each transferred ICI, or ICI block:
 - The network address of the Resolving CMP (or its Split-CMP-Parent, where applicable).
 - Identification information of the Split-CMP-Child, where applicable (e.g. based on one of its assigned Routing Prefixes).

- c) Make the table that contains all transferred ICIs (and updates on newly transferred ICIs) available to its associated CMPs (or Split-CMP-Parents, where applicable).

Note: When the CMPs and/or Split-CMP-Parents are not associated with a MCR, Code Transfer support may be achieved by other methods as part of a MLA, in which case the above actions may not be applicable.

The MCR component (when implemented) uses the following interfaces to communicate with other entities in the Architecture Diagram:

- Interface MC-2 to communicate with its associated CMP (or Split-CMP-Parent, where applicable) for the purpose of:
 - a) Receiving a request to retrieve the network address of the Resolving CMP (or its Split-CMP-Parent, where applicable).
 - b) Sending the network address of the Resolving CMP (or its Split-CMP-Parent and the identification information of the Resolving Split-CMP-Child, where applicable) to the requesting CMP (or Split-CMP-Parent, where applicable).
- Interface MC-5 to communicate with the associated CMP (or Split-CMP-Parent, where applicable) for the purpose of:
 - c) Routing Prefix assignment and update functions.
 - d) Code Transfer management function and updates.

Note: When the CMPs and/or Split-CMP-Parents are not associated with a MCR, the MCR functions in the above (including the management of Routing Prefix assignments to Split-CMP-Child) may be achieved by other methods as part of a MLA, in which case the interfaces above may not be applicable.

5.3.3 Code Management Platform (CMP)

The CMP (or Split-CMP-Parent, applicable to a Split-CMP deployment scenario) component supports the following functions:

1. Registering function: Perform the needed administrative actions to manage Routing Prefix assignments. Among these actions:
 - a) Communicate with its associated MCR, or directly from OMNA, to obtain a Routing Prefix allocation.
 - b) When acting as a Split-CMP-Parent, may also sub allocate Routing Prefixes to other Split CMP /Child(ren) from its range of allocated Routing Prefixes.
2. Code Clearing House (CCH) function: Perform the needed actions to determine the Resolving CMP and redirect the request for Code Resolution to the Resolving CMP (or its Split-CMP-Parent, where applicable) for resolution; and if this request cannot be resolved directly based on the locally stored/cached data, by consulting the MCR to discover the Resolving CMP (or its Split-CMP-Parent, where applicable). Among these actions:
 - a) When associated with a MCR, query the MCR for information on the Resolving CMP (or its Split-CMP-Parent, where applicable).
 - b) When it is part of a MLA, follow the agreed method to determine the Resolving CMP (or its Split-CMP-Parent, where applicable).
 - c) Redirecting the Code Resolution request towards the Resolving CMP (or its Split-CMP-Parent, where applicable).
 - d) Redirect the resolved information towards the CMP (or its Split-CMP-Parent, where applicable) that forwarded the request.

3. Code Transfer handling function (optional): When this function is supported, perform the needed actions to transfer an ICI or a block of ICIs from/to another Resolving CMP (or its Split-CMP-Parent, where applicable). This function can be supported by its associated MCR or through another method agreed in a MLA.
4. Logging and reporting function (optional): When this function is supported, perform the needed actions to exchange chargeable events, tracking, logging, and accounting reporting information from/to another Resolving CMP (or its Split-CMP-Parent, where applicable) or directly to MCPs, as appropriate. In case of a Split-CMP deployment scenario, the CMP (or Split-CMP-Parent) sends reporting information to the Resolving CMP via its Split-CMP-Parent; the Resolving CMP then reports to the MCPs of interest.

The CMP (or Split-CMP-Child, applicable to a Split-CMP deployment scenario) component supports the following functions:

5. Indirect Code Identifier assignment function:
 - a) Assign Resolution Identifier(s) to the Mobile Code Publisher (MCP) under its assigned Routing Prefix(es).
 - b) Ensure the uniqueness of all the assigned Resolution Identifiers within each of its responsible Routing Prefixes.
 - c) Associate content or an address of content (or a service) with each of the assigned Resolution Identifiers.
6. Code Resolution (CR) function: Perform the needed actions to resolve the Indirect Code Identifier received from the Mobile Code Client or another CMP (or its Split-CMP-Parent, where applicable). Among these actions:
 - a) Resolve the Indirect Code Identifier received in the Code Resolution request into associated content or the address of content (or a service). The result may be influenced by taking into account metadata (e.g. information supplied in the request, etc.) and Mobile Code Service Policy, if any.
 - b) Return the resolved information to the Mobile Code Client or the CMP (or its Split-CMP-Parent, where applicable) that originated or forwarded the request, respectively.

The CMP (or Split-CMP, where applicable) uses the following interfaces to communicate with other entities in the Architectural Diagram:

- Interface MC-1, when acting as a Home CMP (or Split-CMP-Parent), to communicate with the MCC for the purpose of:
 - a) Receiving the Code Resolution request from the MCC.
 - b) Returning the resolved information associated with the request received from the MCC.
- Interface MC-3, when acting as a Home CMP (or Split-CMP-Parent), to communicate with another CMP (or Split-CMP-Parent, where applicable) if the original Code Resolution request from an MCC cannot be fulfilled locally, for the purpose of:
 - a) Forwarding the Code Resolution request to another CMP (or Split-CMP-Parent, where applicable) for action.
 - b) Returning resolved information associated with the request from another CMP (or Split-CMP-Parent, where applicable).
- Interface MC-3, when acting as a Remote CMP (or Split-CMP-Child), to communicate with another CMP (or its Split-CMP-Parent, where applicable) for the purpose of:
 - a) Receiving forwarded requests for resolution from another CMP (or Split-CMP-Parent, where applicable).
 - b) Returning resolved information to the CMP (or Split-CMP-Parent, where applicable) that forwarded the request.
- Interface MC-6, when acting as a Home CMP (or Split-CMP-Parent), to communicate with a Remote CMP (or Split-CMP-Parent, where applicable) if the original request from an MCC was resolved at the Remote CMP (or

Split-CMP-Child), for the purpose of forwarding chargeable events, tracking, logging, accounting and reporting information to the Resolving CMP (or its Split-CMP-Parent, where applicable).

- Interface MC-6, when acting as a Home CMP (or Split-CMP-Parent), as an option to communicate with another CMP (or Split-CMP-Parent, where applicable) for the purpose of forwarding tracking and logging, accounting and reporting information, and also for exchanging updates on the Routing Prefixes and transferred ICIs when the MCR functions are achieved through a MLA with other CMPs (or Split-CMP-Parents, where applicable).
- Interface MC-2, when acting as a Home CMP (or Split-CMP-Parent), when associated with a MCR, to communicate with the MCR for the purpose of:
 - a) Sending an unknown Indirect Code Identifier to find out the network address of the Resolving CMP (or its Split-CMP-Parents, where applicable) and the identification information of the Resolving CMP.
 - b) Receiving the network address of the Resolving CMP (or Split-CMP-Parent and the identification information of the Resolving Split-CMP-Child, where applicable).
- Interface MC-5, when acting as a Home CMP (or Split-CMP-Parent), when associated with a MCR, to communicate with the MCR for the purpose of:
 - a) Requesting and receiving the mapping between a Routing Prefix and the corresponding network address of the Resolving CMP (or its Split-CMP-Parent, where applicable) for all sub-allocated Routing Prefixes from the MCR.
 - b) Requesting and receiving a Routing Prefix from the MCR.
 - c) Handling Code Transfer when the MCR is involved in managing Code Transfer.
 - d) Receiving updates on Routing Prefixes and/or (optionally) transferred ICIs.

5.4 Security Considerations

5.4.1 Security for Direct Codes

This MC Enabler Release does not cover security for Direct Codes.

5.4.2 Security for Indirect Codes

In this MC Enabler Release, the MCC is only responsible for sending the decoded Indirect Code Identifier and (optionally) associated security data to the Home CMP (or Split-CMP-Parent, where applicable). This allows for an appropriate network entity to authenticate the Indirect Code Identifier using standard and well-known security algorithms.

The MC Enabler network entities are required to be trusted servers, hence appropriate security measures are required as part of the technical specification (e.g. using HTTPS).

Appendix A. Change History

(Informative)

A.1 Approved Version History

Reference	Date	Description
n/a	n/a	No prior version

A.2 Draft/Candidate Version 1.0 History

Document Identifier	Date	Sections	Description
Draft Versions OMA-AD-MC-V1_0	22 Oct 2008	Cover page, 1, 2, 4	Baseline Names and dated AD. Added editor's notes to note copy/paste from the RD.
	26 Feb 2009	Cover page, 5.1, Annex	Implemented: OMA-MC-2009-0026R02-CR_MC_Architecture_Diagram OMA-MC-2009-0012R02-CR_Flows_with_Single_CMP OMA-MC-2009-0013R02-CR_Flows_with_Single_CCH OMA-MC-2009-0014R02-CR_Flows_from_CMP_to_CMP OMA-MC-2009-0015R02-CR_Flows_from_CCH_to_CCH OMA-MC-2009-0016R02-CR_Flows_from_CMP_to_CCH OMA-MC-2009-0017R02-CR_Flows_from_CCH_to_CMP Deleted some template comments for clarity.
	06 Apr 2009	Cover page, 1, 2, 3, 4, 5, Change log	Implemented: OMA-MC-2009-0049- CR_Adding_Scope,_References,_Definitions_to_AD OMA-MC-2009-0051- CR_Adding_Introduction_and_Versioning_to_AD OMA-MC-2009-0031- CR_to_AD_sub_section_on_Functional_Component_CMP_and_related _Interfaces_ OMA-MC-2009-0033-CR_Agreed_texts_for_MCC_and_GMCR OMA-MC-2009-0034R02-CR_Proposed_texts_for_CCH_and_CRS OMA-MC-2009-0043R01-CR_AD_Text_For_Interfaces Edited Architectural diagrams to insert arrows to clarify that the MC Enabler uses Interfaces, rather than Reference Points. Deleted some template comments for populated sections.
	07 Apr 2009	Change log	Added CR 0043R01 to the change log from 06 Apr 2009 Added sections changed to the change log from 06 Apr 2009
	22 Jun 2009	Change log, 5.2.1	Implemented: OMA-MC-2009-0062- CR_AD_text_for_MC_interaction_with_other_enablers
	25 Jun 2009	Change log,	Added general text on Architecture, Dependencies section and Security Considerations section. Updated architectural diagrams.

Document Identifier	Date	Sections	Description
	15 July 2009	Changelog, Appendix B, 2.2, 3.3, 5.	<p>During drafting session at OMA Boston:</p> <p>Added Security Considerations Re-drew all architectural diagrams Inserted legend to architectural diagrams Added architectural introduction Added Dependencies section</p> <p>During editorial time after OMA Boston:</p> <p>Implemented: OMA-MC-2009-0090R01-CR_AD_Update_References_to_Interfaces OMA-MC-2009-0104R03-CR_Code_Transfer_Information_Flows OMA-MC-2009-0105R01-CR_Code_Transfer_Related_Changes OMA-MC-2009-0106R02-CR_Information_Flows_for_Routing_Prefix_Assignment OMA-MC-2009-0107R02-CR_Offline_GMCR_Function</p> <p>Added references for dependencies Added GMCR working assumptions from OMA-MC-2009-0101R03-INP_Release_1_Working_Assumptions Editorial clean-up of section 5 for consistency. Captioned all figures, created Figure Table Tidied all Headings & updated Index</p>
	11 Aug 2009	Changelog, all sections	<p>Implemented all AGREED CRs up to and including resolved comments of the AD R&A which was closed on 2009-07-27. OMA-MC-2009-0113-CR_Comments_on_architecture_diagram OMA-MC-2009-0115-CR_Security_Considerations OMA-MC-2009-0116R01-CR_Additional_abbreviations OMA-MC-2009-0122-CR_Appendix_B OMA-MC-2009-0123-CR_New_abbreviation_for_ICI OMA-MC-2009-0124R01-CR_AD_Section_5.3.2_GMCR</p> <p>General editorial clean-up applied. Consistent numbering scheme/style applied. Note: Table of Content/Figure numbers need fixing; Architecture Diagrams optional interfaces need fixing.</p>
	21 Aug 2009	Changelog, 5.2	<p>Corrected the Architecture Diagrams showing the MC-2 interface as in-scope of the MC Enabler. Updated Table of Content and Figure numbers.</p>
	29 Oct 2009	Chnagelog, 3, 5.2, 5.3	<p>Implemented: OMA-MC-2009-0168R01-CR_ADRR_Comment_063_and_102_Actor_Definitions OMA-MC-2009-0169-CR_ADRR_Comments_068_and_107_Interfcae_Definitons</p>
	05 Nov 2009	All	<p>Implemented: OMA-MC-2009-0167R02-CR_ADRR_Comment_059_GMCR OMA-MC-2009-0170R01-CR_ADRR_Comment_095_Architecture_Diagrams</p> <p>Editorial clean-up</p>
	16 Nov 2009	All	<p>Implemented: All miscellaneous agreed changes for comment resolution as per the ADRR dated 04 Nov 2009. General editorial clean-up. Updates of the Table of Content and Figures Numbering.</p>

Document Identifier	Date	Sections	Description
	02 Feb 2010	All	Implemented: OMA-MC-2009-0185R01- CR_AD_diagrams_based_on_ARC_WG_recommendations. OMA-MC-2010-0005R01-CR_to_MC_AD_sect_5_3_2_Global_MCR. In addition, "Appendix B – Flows (Informative)" was simplified by updating and aligning terminology with the revised architecture diagram and explanations; also, some flows deemed unnecessary were removed. General updates of the Table of Content and numbering of Figures and sections numbering throughout.
Candidate Versions OMA-AD-MC-V1_0	02 Mar 2010	All	Status changed to Candidate by TP ref #OMA-TP-2010-0067-INP_MC_V1_0_AD_for_Candidate_approval

Appendix B. Flows

(Informative)

Sections B.1 – B.4 depict example flows. In all cases, access to the Mobile Code Registry (MCR) functions can be achieved by using the MC-5 interface in a MCR implementation, or through Multi-lateral Arrangements amongst the CMPs, Split-CMP-Parents and/or the Split-CMP-Children concerned (see Section 5.3.2 - MCR).

B.1 Routing Prefix Assignment/Update

This section describes the example flows on Routing Prefix assignments by the MCR functions and on updating the CMPs (or Split-CMP-Parents) with new or modified Routing Prefix information.

B.1.1 Routing Prefix Assignment Involving CMP and MCR

B.1.1.1 Short Description

The CMP needs to get a new or an additional Routing Prefix. This section shows an example information flow where a CMP requests for a Routing Prefix and is assigned one by the MCR functions.

B.1.1.2 Flow

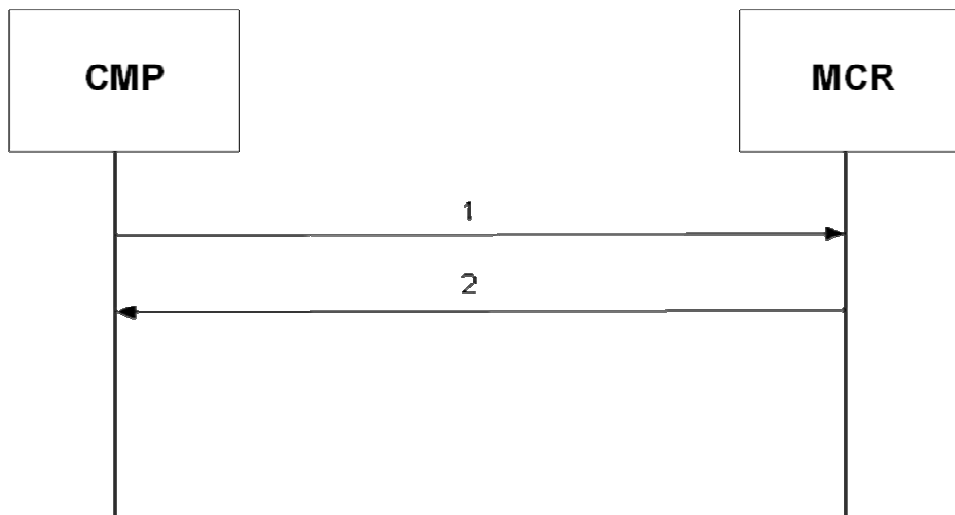


Figure 4: Example Flow - CMP Routing Prefix Assignment

1. The CMP requests for a Routing Prefix from the MCR with its network address to be associated with the to-be-assigned Routing Prefix.
2. The MCR assigns and returns a Routing Prefix to the CMP and stores the assigned Routing Prefix and the associated network address of the CMP. This may be done by using the MC-5 interface or through Multi-lateral Arrangements.

B.1.2 Routing Prefix Assignment Involving Split-CMP-Parent, Split-CMP-Child and MCR

B.1.2.1 Short Description

The Split-CMP-Child needs to get a new or an additional Routing Prefix. This section shows two example information flows where (a) a Split-CMP-Child goes through its parent Split-CMP-Parent to request for a Routing Prefix and is assigned

one by the MCR, and (b) a Split-CMP-Child goes directly to the MCR after communicating with the Split-CMP-Parent and obtaining its network address.

B.1.2.2 Flow A

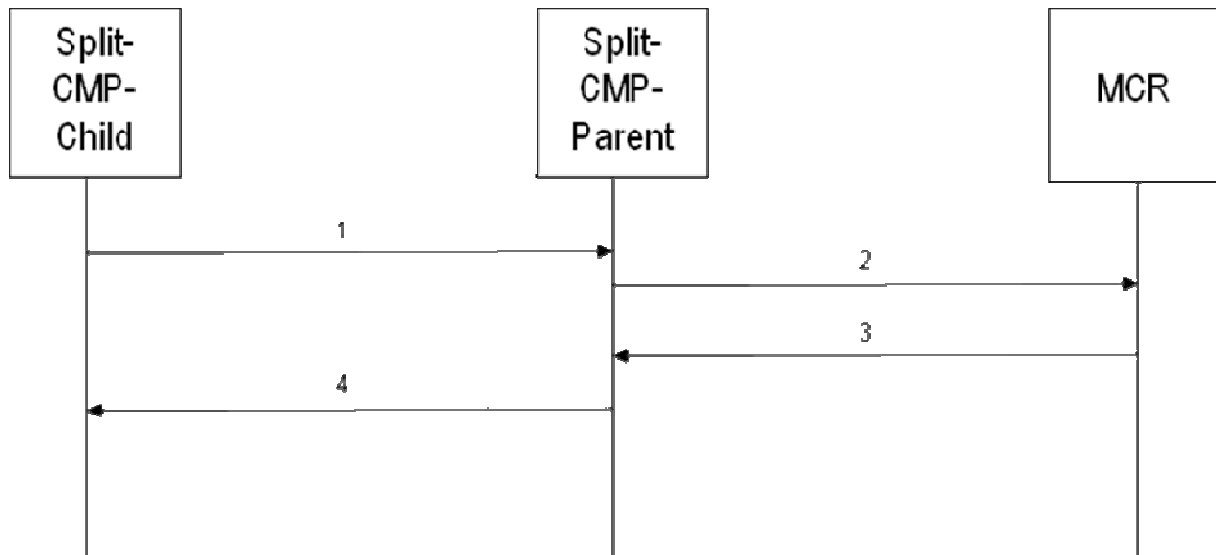


Figure 5: Example Flow A – Split-CMP-Child Routing Prefix Assignment

1. The Split-CMP-Child requests for a Routing Prefix from its Split-CMP-Parent with its network address.
2. The Split-CMP-Parent requests for a Routing Prefix from the MCR with its network address to be associated with the to-be-assigned Routing Prefix. Information about the Split-CMP-Child that is to be assigned with a Routing Prefix may be passed to the MCR in case that the Split-CMP-Parent is suddenly out of business and the MCR needs to know which Split-CMP-Children are served by that Split-CMP-Parent. This may be done by using the MC-5 interface or through Multi-lateral Arrangements.
3. The MCR assigns and returns a Routing Prefix to the Split-CMP-Parent and stores the assigned Routing Prefix, the associated network address of Split-CMP-Parent and the information on the Split-CMP-Child that is assigned the Routing Prefix if available. This may be done by using the MC-5 interface or through Multi-lateral Arrangements.
4. The Split-CMP-Parent returns the assigned Routing Prefix to the Split-CMP-Child.

B.1.2.3 Flow B

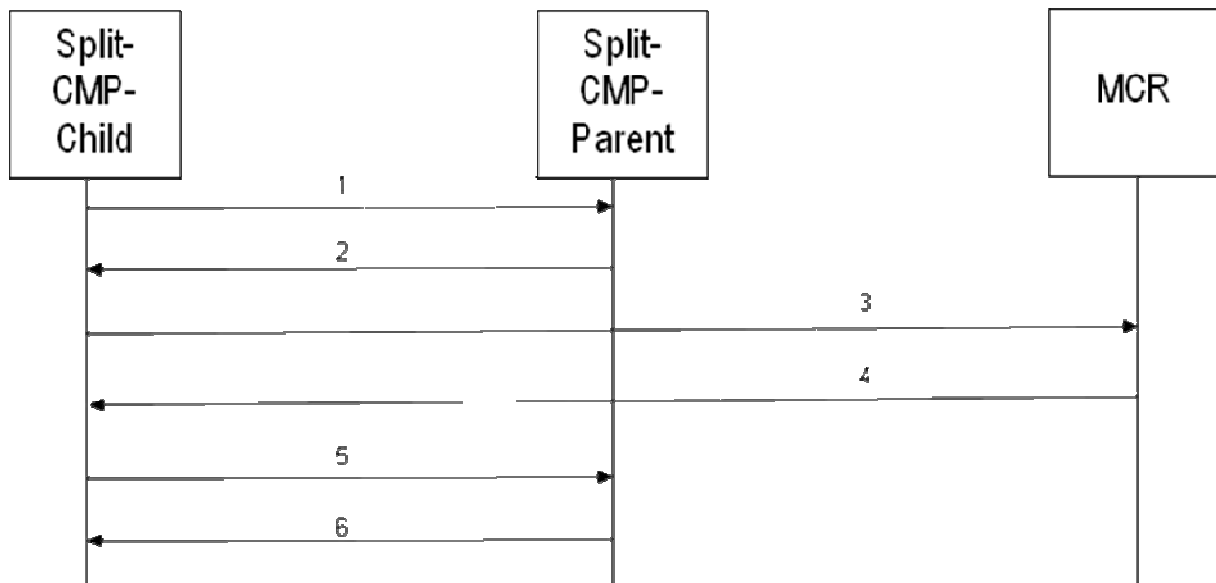


Figure 6: Example Flow B – Split-CMP-Child Routing Prefix Assignment

1. The Split-CMP-Child requests for the network address from its parent Split-CMP-Parent.
2. The Split-CMP-Parent returns its network address to the Split-CMP-Child.
3. The Split-CMP-Child requests for a Routing Prefix from the MCR with the network address of its Split-CMP-Parent that is to be associated with the to-be-assigned Routing Prefix. Information about the Split-CMP-Child that is to be assigned with a Routing Prefix may be provided to the MCR. This may be done by using the MC-5 interface or through Multi-lateral Arrangements.
4. The MCR assigns and returns a Routing Prefix to the Split-CMP-Child and stores the assigned Routing Prefix, the associated network address of its Split-CMP-Parent and the information on the Split-CMP-Child that is assigned the Routing Prefix if available. This may be done by using the MC-5 interface or through Multi-lateral Arrangements.
5. The Split-CMP-Child informs its Split-CMP-Parent about its network address and the assigned Routing Prefix.
6. The Split-CMP-Parent acknowledges the receipt of the information.

B.1.3 Routing Prefix Update Involving CMPs, Split-CMP-Parents and MCR over MC-5 Interface

B.1.3.1 Short Description

After the successful completion of a Routing Prefix assignment, the MCR may update those Split-CMP-Parents/CMPs that receive downloads/updates of assigned Routing Prefixes from the MCR. The update can happen right after the successful completion of a transaction to assign a Routing Prefix and/or at specific times (e.g., every 15 minutes). Only one CMP, “CMPi”, and one Split-CMP-Parent, “Split-CMP-Pn”, are shown to represent those CMPs and Split-CMP-Parents that receive downloads/updates from the MCR.

B.1.3.2 Flow

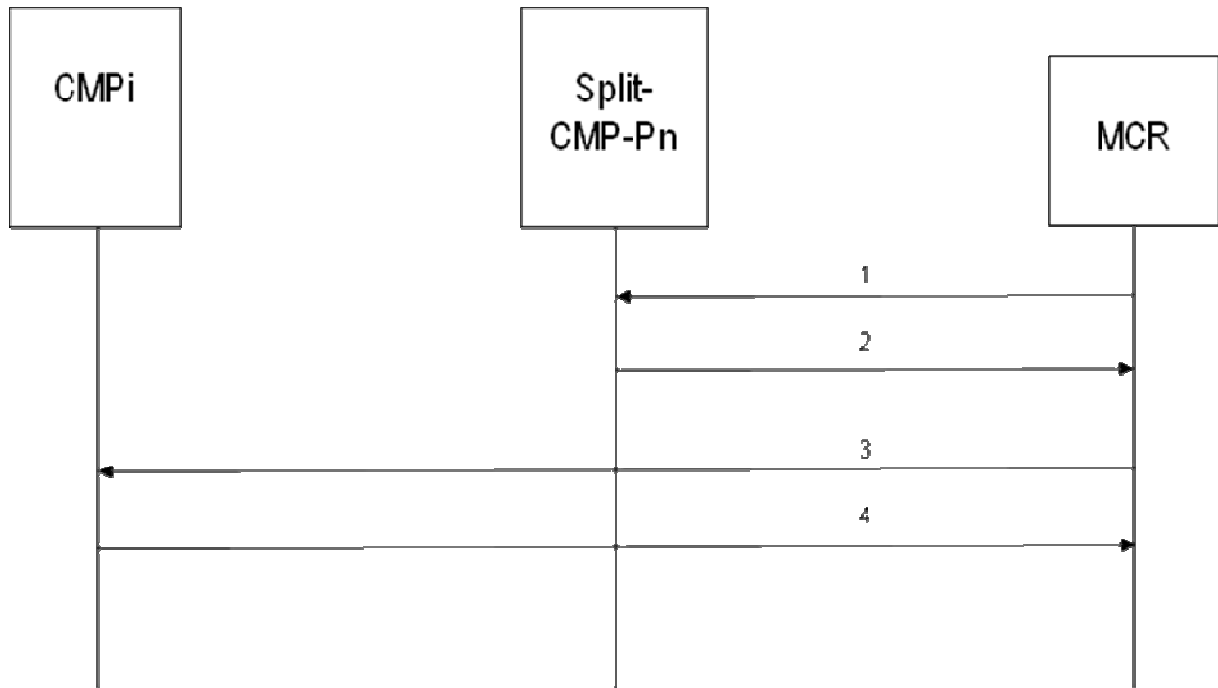


Figure 7: Example Flow - Routing Prefix Update Involving CMPs, Split-CMP-Parents and MCR

1. The MCR updates Split-CMP-Pn on the assigned Routing Prefixes that were assigned after the last update.
2. The Split-CMP-Pn acknowledges the receipt of the update.
3. The MCR updates CMPi on the assigned Routing Prefixes that were assigned after the last update.
4. The CMPi acknowledges the receipt of the update.

Note: The update includes any changes to the Routing Prefixes assigned by the MCR that may be caused by reasons other than new Routing Prefix assignment (e.g., the network address of the CMP or the Split-CMP-Parent for an assigned Routing Prefix has changed).

B.1.4 Routing Prefix Update Using Offline MCR Functions

The designated responsible party for managing the Primary Routing Prefix shall publish the following information for the participating CMPs (also Split-CMP-Parents or Split-CMP-Children) that choose to make the information public:

1. The availability of the CMP (or Split-CMP-Parent) for Multi-lateral Arrangements with other CMPs (or Split-CMP-Parents) for routing of ICIs not served by it.
2. The availability of the CMP (or Split-CMP-Parent) for Multi-lateral Arrangements with other CMPs (or Split-CMP-Parents) that may scan ICIs served by the former.
3. The availability of the CMP (or Split-CMP-Child and its Split-CMP-Parent) for the optional Code Transfer Service. Optionally, it may also list the minimum size of a contiguous range that a CMP (or Split-CMP-Child and its Split-CMP-Parent) will accept for this service – a size of 1 indicates that the CMP (or Split-CMP-Child and its Split-CMP-Parent) will service singleton Codes.

4. The contact information for the CMP (or Split-CMP-Parent or Split-CMP-Child).
5. If provided, the network address of the CMP (or Split-CMP-Parent).

During the term of the Multi-lateral Arrangements, a CMP (or Split-CMP-Parent) updates its local cache when it is notified of changes to a network addresses associated with any of the Routing Prefixes resident in its local cache by the CMP (or Split-CMP-Parent or Split-CMP-Children) that is responsible for that Routing Prefix. This is done following the normal operational procedures for system updates for the CMP (or Split-CMP-Parent).

B.2 ICI Resolution

B.2.1 Home CMP Resolves ICI

B.2.1.1 Short Description

The home CMP receives a request for resolving an ICI from the MCC; it resolves the ICI and sends the result to the MCC.

B.2.1.2 Flow

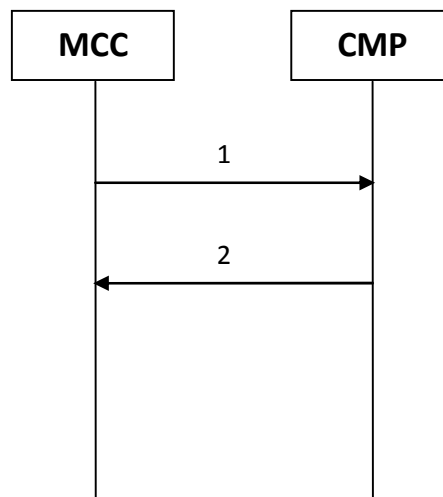


Figure 8: Example Flow - Home CMP Resolves the ICI

1. The MCC decodes an Indirect Code and sends the request for resolving the ICI to the home CMP.
2. The home CMP, which is responsible for resolving the ICI, resolves the ICI and sends the result to the MCC.

B.2.2 Split-CMP-Child Associated with Home Split-CMP-Parent Resolves ICI

B.2.2.1 Short Description

The home Split-CMP-Parent receives a request for resolving an ICI from the MCC, determines that the resolving CMP is associated with it (i.e. as its Split-CMP-Child) and then sends the request to the resolving CMP. The Split-CMP-Child resolves it and sends the result to the home Split-CMP-Parent, which then sends the result to the MCC.

B.2.2.2 Flow

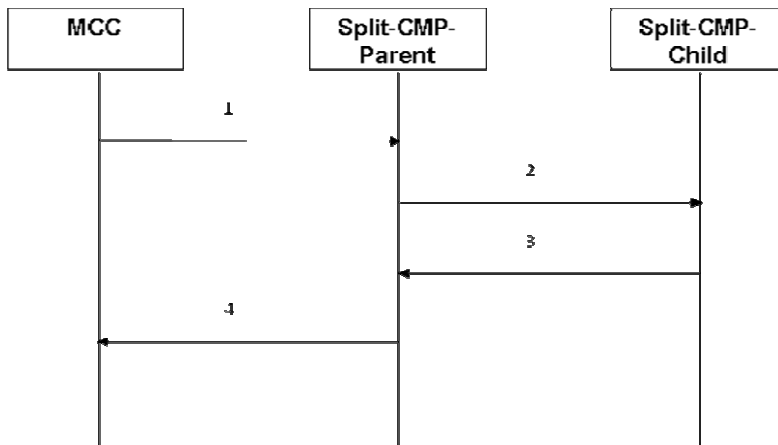


Figure 9: Example Flow – Split-CMP-Child Associated with Home Split-CMP-Parent Resolves the ICI

1. The MCC decodes an Indirect Code and sends the request for resolving the ICI to the home Split-CMP Parent.
2. The home Split-CMP Parent determines that the resolving CMP is associated with it (as its Split-CMP-Child) and sends the request to the resolving CMP.
3. The Split-CMP Child resolves the ICI and sends the result to the home Split-CMP Parent.
4. The home Split-CMP Parent sends the result to the MCC.

B.2.3 Remote CMP Resolves ICI Involving Home CMP

B.2.3.1 Short Description

The home CMP receives a request for resolving an ICI from the MCC, and then sends the request to the Remote CMP. The Remote CMP resolves the ICI and sends the result to the home CMP, and the home CMP sends the result to the MCC.

B.2.3.2 Flow

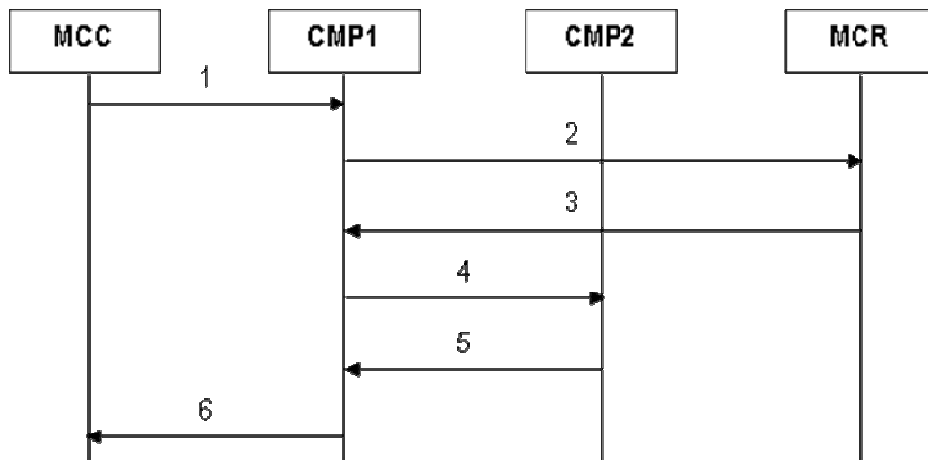


Figure 10: Example Flow - Remote CMP Resolves the ICI Involving Home CMP

1. The MCC decodes a Mobile Code and sends the ICI to the home CMP, CMP1, for resolution.
2. CMP1 checks the ICI and finds that it cannot resolve the ICI, then searches its local cache for information on the appropriate CMP2 (i.e. either another CMP or Split-CMP-Parent). This cache may be updated by querying the MCR using the MC-2 interface or receiving updates from the MCR over the MC-5 interface, or through Multi-lateral Arrangements.
3. When queried using the MC-2 interface, the MCR responds to CMP1 that CMP2 is responsible for resolving the ICI.
4. CMP1 sends the request to CMP2.
5. CMP2 resolves the ICI and sends the result to CMP1.
6. CMP1 sends the result to the MCC.

B.2.4 Remote Split-CMP-Child Resolves ICI Involving Home Split-CMP-Parent and Remote Split-CMP-Parent

B.2.4.1 Short Description

The home Split-CMP-Parent receives a request for resolving an ICI from the MCC, determines that another Split-CMP-Parent is to handle the request and then sends it to the Remote Split-CMP-Parent. The Remote Split-CMP-Parent sends the request to the resolving Split-CMP-Child. The Split-CMP-Child resolves the ICI and sends the result to the home Split-CMP-Parent. The home Split-CMP-Parent sends the result to the MCC.

B.2.4.2 Flow

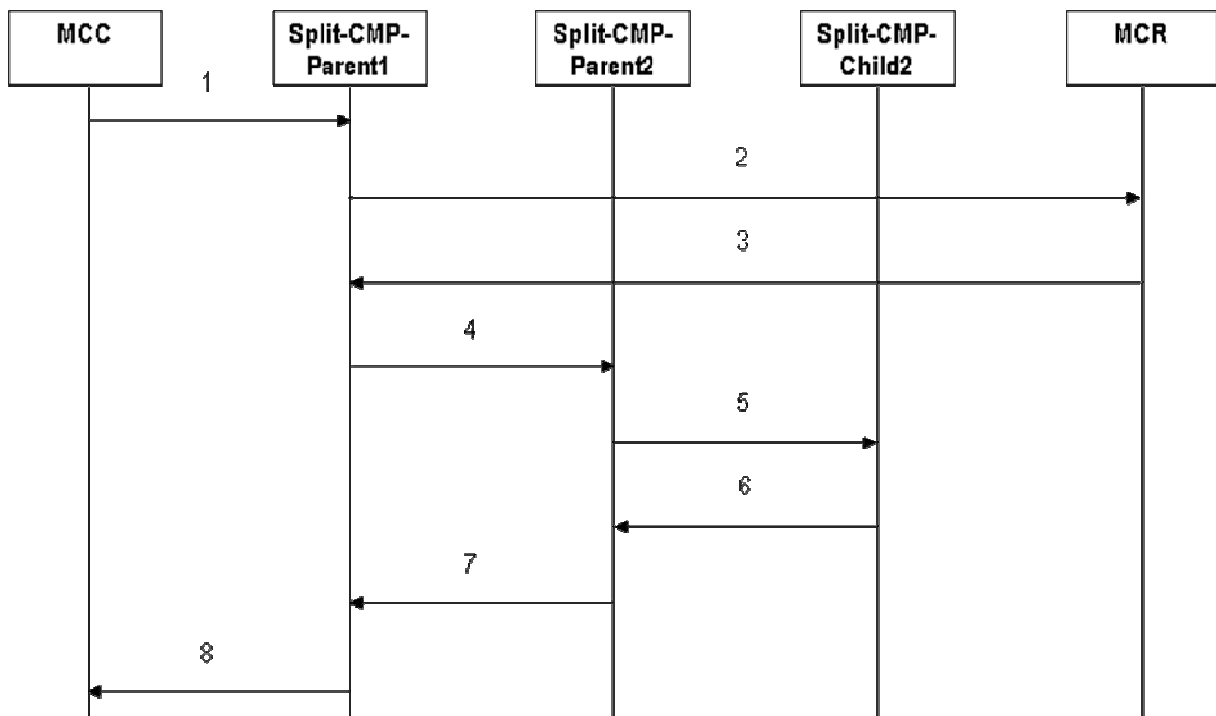


Figure 11: Example Flow – Remote Split-CMP-Child Resolves the ICI Involving Home Split-CMP-Parent and Remote Split-CMP-Parent

1. The MCC decodes an Indirect Code and sends the request for resolving the ICI to the home Split-CMP-Parent, "Split-CMP-Parent1".
2. Split-CMP-Parent1 finds that none of its associated Split-CMP-Children can resolve the ICI, and then searches its local cache for information on the appropriate CMP/ Split-CMP-Parent. This cache may be updated by querying the MCR using the MC-2 interface or receiving updates from the MCR over the MC-5 interface, or through Multi-lateral arrangements.
3. When queried using the MC-2 interface, the MCR responds to Split-CMP-Parent1 that Split-CMP-Parent2 is responsible for further routing.
4. Split-CMP-Parent1 sends the request to Split-CMP-Parent2.
5. Split-CMP-Parent2 sends the request to the resolving Split-CMP-Child, "Split-CMP-Child2".
6. Split-CMP-Child2 resolves the ICI and sends the result to Split-CMP-Parent2.
7. Split-CMP-Parent2 sends the result to Split-CMP-Parent1.
8. Split-CMP-Parent1 sends the result to the MCC.

B.2.5 Remote Split-CMP-Child Resolves ICI Involving Home CMP and Remote Split-CMP-Parent

B.2.5.1 Short Description

The home CMP receives a request for resolving an ICI from the MCC, determines that another Split-CMP-Parent is to handle the request and then sends the request to the Remote Split-CMP-Parent. The Remote Split-CMP-Parent sends the request to the resolving Split-CMP-Child. The Split-CMP-Child resolves the ICI and sends the result to the Remote Split-CMP-Parent. The Remote Split-CMP-Parent sends the result to the home CMP, and the home CMP sends the result to the MCC.

B.2.5.2 Flow

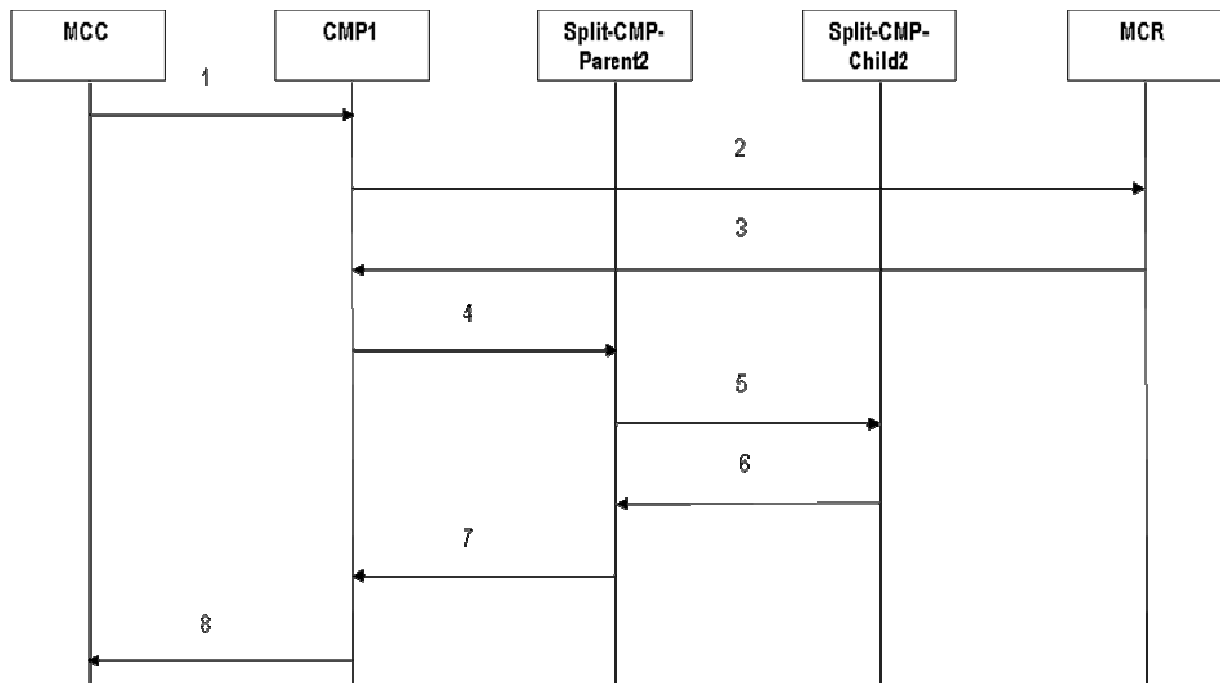


Figure 12: Example Flow – Remote Split-CMP-Child Resolves the ICI Involving Home CMP and Remote Split-CMP-Parent

1. The MCC decodes an Indirect Code and sends the request for resolving the ICI to the home CMP, “CMP1”.
2. CMP1 finds that it cannot resolve the ICI and then searches its local cache for information on the appropriate Split-CMP-Parent. This cache may be updated by querying the MCR using the MC-2 interface or receiving updates from the MCR over the MC-5 interface, or through Multi-lateral arrangements.
3. When queried using the MC-2 interface, the MCR responds to CMP1 that Split-CMP-Parent2 is responsible for further routing.
4. CMP1 sends the request to Split-CMP-Parent2.
5. Split-CMP-Parent2 sends the request to the resolving Split-CMP-Child, “Split-CMP-Child2”.
6. Split-CMP-Child2 resolves the ICI and sends the result to Split-CMP-Parent2.
7. Split-CMP-Parent2 sends the result to CMP1.
8. CMP1 sends the result to the MCC.

B.2.6 Remote CMP Resolves ICI Involving Home Split-CMP-Parent

B.2.6.1 Short Description

The home Split-CMP-Parent receives a request for resolving an ICI from the MCC, determines that another CMP is to handle the request and then sends the request to the Remote CMP. The Remote CMP resolves the ICI and sends the result to the home Split-CMP-Parent. The home Split-CMP-Parent sends the result to the MCC.

B.2.6.2 Flow

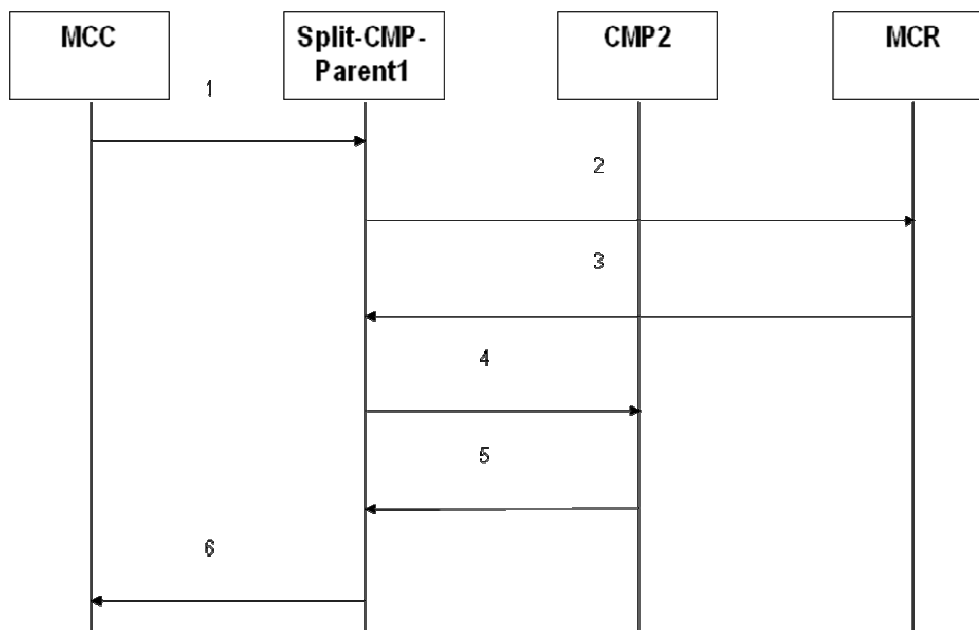


Figure 13: Example Flow – Remote CMP Resolves ICI Involving Home Split-CMP-Parent

1. The MCC decodes an Indirect Code and sends the request for resolving the ICI to the home Split-CMP-Parent, “Split-CMP-Parent1”.
2. Split-CMP-Parent1 finds that none of its associated Split-CMP-Children can resolve the ICI, searches its local cache for information on the appropriate CMP (or Split-CMP-Parent). This cache may be updated by querying the MCR

using the MC-2 interface or receiving updates from the MCR over the MC-5 interface, or through Multi-lateral Arrangements.

3. When queried using the MC-2 interface, the MCR responds to Split-CMP-Parent1 that CMP2 is responsible for resolving the ICI.
4. Split-CMP-Parent1 sends the request to CMP2.
5. CMP2 resolves the ICI and sends the result to Split-CMP-Parent1.
6. Split-CMP-Parent1 sends the result to the MCC.

B.3 Code Transfer and Transferred ICI Information Update

This section describes the example flows on code transfer where an MCP changes the ICI resolution service provider (e.g., CMP (or Split-CMP-Child) from one to another and on updating the CMPs (or Split-CMP-Parents) with the transferred ICI information after an ICI or an ICI block has been successfully transferred. Code transfers and transferred ICI information updates can be managed by a local Mobile Code Registry or via Multi-lateral Arrangements.

Only code transfers between two CMPs and between two Split-CMP-Children are described. Code transfer from a donor CMP (or Split-CMP-Child) to a receiver Split-CMP-Child (or CMP) can be easily derived from the case between two Split-CMP-Children by combining the donor Split-CMP-Child and its Split-CMP-Parent to the donor CMP or by combining the receiver Split-CMP-Child and its Split-CMP-Parent to the receiver CMP.

B.3.1 Code Transfer and Transferred ICI Information Update over MC-5 Interface

This section describes the example flows where the MCR functions, which are instantiated by a local Mobile Code Registry, manage the code transfers and transferred ICI information updates.

B.3.1.1 Code Transfer Involving CMPs and MCR over MC-5 Interface

B.3.1.1.1 Short Description

This section shows an example information flow where the MCR handles the ICI transfer between two CMPs where CMP1 is the donor CMP, the one losing the ICI, and CMP2 is the receiver CMP, the one gaining the ICI.

B.3.1.1.2 Flow

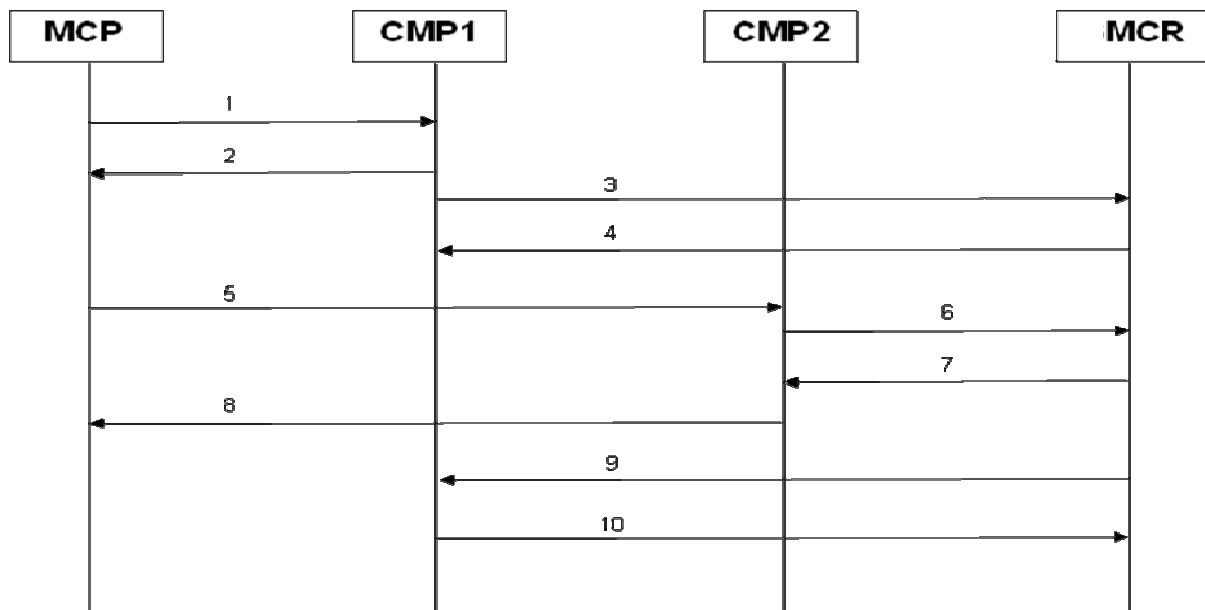


Figure 14: Example Flow - Code Transfer Involving CMPs and the MCR

1. The MCP informs CMP1 that it wants to transfer its ICI(s) to another CMP.
2. CMP1 assigns and returns a confirmation token to the MCP.
3. CMP1 reports the to-be-transferred ICI(s) and the associated confirmation token to the MCR.
4. The MCR acknowledges the receipt of the information.
5. The MCP requests to transfer its ICI(s) to CMP2. The MCP provides information on how its ICI (or ICIs) is/are to be mapped.
6. CMP2 requests code transfer with the to-be-transferred ICI(s) and the associated confirmation token and its network address to the MCR.
7. The MCR verifies that the confirmation token received in the request from CMP2 matches with that reported by CMP1 for the to-be-transferred ICI(s) and acknowledges the successful completion of code transfer.
8. CMP2 informs the MCP about the successful completion of code transfer.
9. The MCR notifies CMP1 about the successful completion of code transfer.
10. CMP1 acknowledges the receipt of the notification.

Note: CMP1 can perform step #2 after receiving the acknowledgement from the MCR at step #4.

B.3.1.2 Code Transfer Involving Split-CMP-Parents, Split-CMP-Children and MCR over MC-5 Interface

B.3.1.2.1 Short Description

This section shows an example information flow where the MCR handles the code transfer between two Split-CMP-Children via their Split-CMP-Parents. Split-CMP-Child1 is the donor Split-CMP-Child, and Split-CMP-Child2 is the receiver Split-CMP-Child. Split-CMP-Parent1 and Split-CMP-Parent2 is the parent of Split-CMP-Child1 and Split-CMP-Child2, respectively.

B.3.1.2.2 Flow

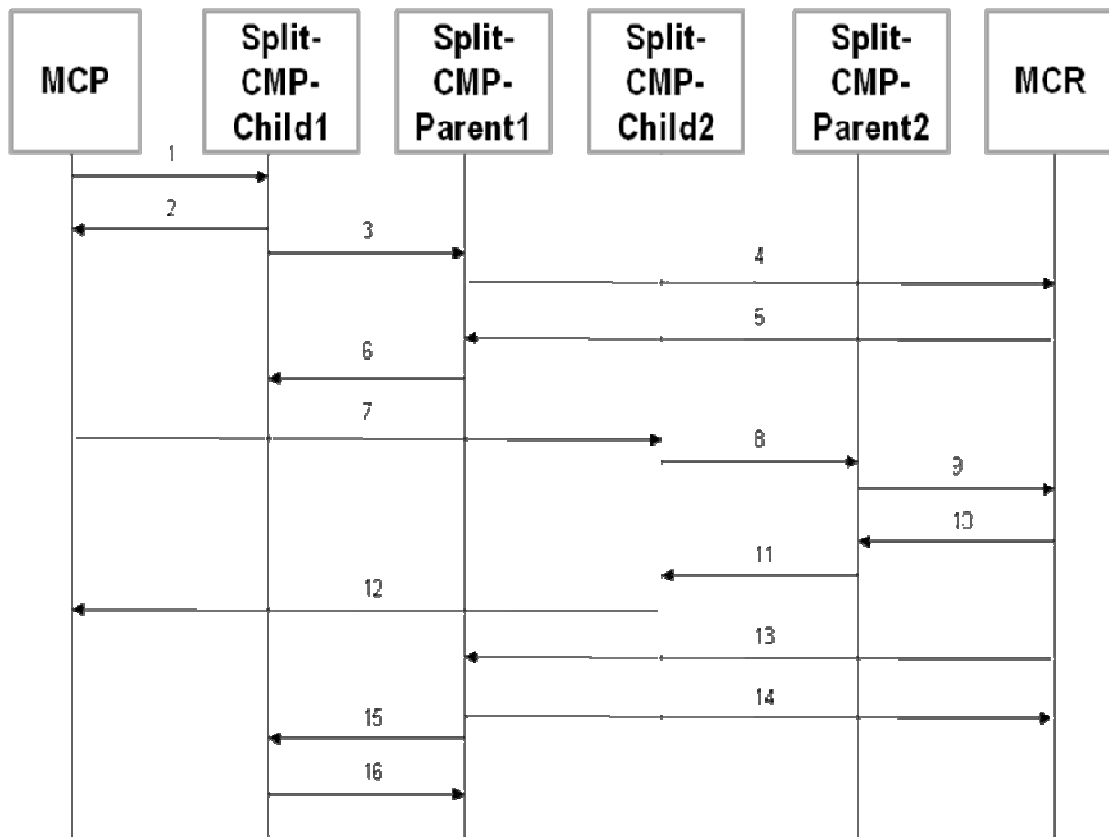


Figure 15: Example Flow - Code Transfer Involving Split-CMP-Parents, Split-CMP-Children and the MCR

1. The MCP informs Split-CMP-Child1 that it wants to transfer its ICI(s) to another Split-CMP-Child.
2. Split-CMP-Child1 assigns and returns a confirmation token to the MCP.
3. Split-CMP-Child1 reports the to-be-transferred ICI(s) and the associated confirmation token to Split-CMP-Parent1.
4. Split-CMP-Parent1 reports the to-be-transferred ICI(s) and the associated confirmation token to the MCR.
5. The MCR acknowledges the receipt of the information.
6. Split-CMP-Parent1 indicates to Split-CMP-Child1 that it has reported the code transfer to the MCR.
7. The MCP requests to transfer its ICI(s) to Split-CMP-Child2. The MCP provides information on how its ICI (or ICIs) is/are to be mapped.
8. Split-CMP-Child2 requests code transfer with the to-be-transferred ICI(s), the associated confirmation token and its network address to Split-CMP-Parent2.
9. Split-CMP-Parent2 requests code transfer with the to-be-transferred ICI(s), the associated confirmation token, identity of Split-CMP-Child2 (e.g., one of the Routing Prefixes assigned to Split-CMP-Child2) and its network address to the MCR.
10. The MCR verifies that the confirmation token received in the request from Split-CMP-Parent2 matches with that reported by Split-CMP-Parent1 for the to-be-transferred ICI(s) and acknowledges the successful completion of code transfer.
11. Split-CMP-Parent2 informs Split-CMP-Child2 about the successful completion of code transfer.
12. Split-CMP-Child2 informs the MCP about the successful completion of code transfer.

13. The MCR notifies Split-CMP-Parent1 about the successful completion of code transfer.
14. Split-CMP-Parent1 acknowledges the receipt of the notification.
15. Split-CMP-Parent1 notifies Split-CMP-Child1 about the successful completion of code transfer.
16. Split-CMP-Child1 acknowledges the receipt of the notification.

Note: Split-CMP-Child1 can perform step #2 after receiving the acknowledgement from the Split-CMP-Parent1 at step #6.

B.3.1.3 Transferred ICI Information Update Involving CMPs, Split-CMP-Parents and MCR over MC-5 Interface

B.3.1.3.1 Short Description

After the successful completion of ICI transfer, the MCR may update those Split-CMP-Parents/CMPs that receive downloads/updates of transferred ICIs from the MCR. The update can happen right after the successful completion of a transaction to transfer an ICI or a block of ICIs and/or at specific times (e.g., every 15 minutes). Only one CMP, “CMPi”, and one “Split-CMP-Pn”, are shown to represent those CMPs and Split-CMP-Parents that receive downloads/updates from the MCR.

B.3.1.3.2 Flow

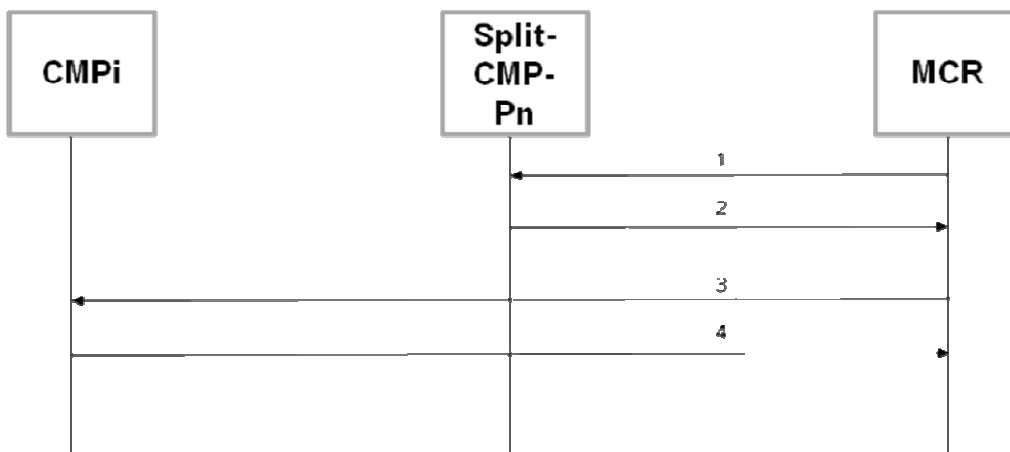


Figure 16: Example Flow - Transferred ICI Update Involving CMPs, Split-CMP-Parents and the MCR

1. The MCR updates Split-CMP-Pn on the ICIs that were transferred after the last update.
2. Split-CMP-Pn acknowledges the receipt of the update.
3. The MCR updates CMPi on the ICIs that were transferred after the last update.
4. CMPi acknowledges the receipt of the update.

Note: The update includes any changes to the information associated with the ICIs registered at the MCR that may be caused by reasons other than code transfer (e.g., the Split-CMP-Child (or CMP) disconnected the service of a transferred ICI belonging to an MCP and the resolving Split-CMP-Child’ Split-CMP-Parent (or resolving CMP) reports that to the MCR).

B.3.2 Code Transfer and Transferred ICI Information Update Using Offline MCR Functions

B.3.2.1 A CMP (or Split-CMP-Child) Is No Longer Operational

The transfer of ICIs when a CMP (or Split-CMP-Child) is no longer operational (e.g., going out of business) is accomplished by:

1. The transfer of all the Routing Prefixes served by that CMP (or Split-CMP-Child) to a receiver CMP (or Split-CMP-Child).
2. The update of the local cache of all CMPs (or Split-CMP-Parents of the Split-CMP-Children) with which the donor CMP (or Split-CMP-Child and its Split-CMP-Parent) had Multi-lateral Arrangements, for interoperability.

B.3.2.2 Between Split-CMP-Children Served by the Same Split-CMP-Parent

The transfer of ICIs from a Split-CMP-Child to another Split-CMP-Child served by the same Split-CMP-Parent is accomplished by the Split-CMP-Parent updating its internal Split-CMP-Child registry cache.

B.3.2.3 Between 2 CMPs or between 2 Split-CMP-Children Served by Different Split-CMP-Parents

The transfer of ICIs between 2 CMPs or between 2 Split-CMP-Children served by different Split-CMP-Parents is done in the following manner after the necessary Multi-lateral Arrangements are in place:

1. First, the Routing Prefix Block for the set of ICIs to be transferred is determined.
2. The receiver CMP (or Split-CMP-Child) provides the donor CMP (or Split-CMP-Child) with the following:
 - a) The Routing Prefix Block (a contiguous block of ICIs) to be transferred.
 - b) The network address of the receiver CMP (or the Split-CMP-Parent of the receiver Split-CMP-Child).
3. The donor CMP (or Split-CMP-Child), after proper authentication, forwards the associated resolution data content of the ICIs to be transferred to the receiver CMP (or Split-CMP-Child).
4. The receiver CMP (or the Split-CMP-Parent of the Split-CMP-Child) sends updates of the transferred Routing Prefix Block to all CMPs and Split-CMP-Parents it has business arrangements with.
5. (Online) The donor CMP(Split-CMP-Child) does the following:
 - a) Marks each ICI starting with the Routing Prefix Block as “Transferred” – cannot be reallocated until they expire.
 - b) Replaces old resolution data content with the network address provided by the receiver CMP (or Split-CMP-Parent of the receiver Split-CMP-Child).

When an MCC scans a “ported” ICI:

6. If home CMP (or Split-CMP-Parent) is the receiver CMP (or Split-CMP-Parent of the receiver Split-CMP-Child), the ICI will resolve successfully on the home CMP.
7. If home CMP (or Split-CMP-Parent) has a business arrangement with the receiver CMP (or Split-CMP-Parent of the receiver Split-CMP-Child), the Code will resolve successfully on the remote (receiver) CMP (or Split-CMP-Parent of the Split-CMP-Child).
8. If home CMP (or Split-CMP-Parent) does not have a business arrangement with the receiver CMP (or Split-CMP-Parent of the receiver Split-CMP-Child), the Code will resolve successfully on the remote (receiver) CMP (or Split-CMP-Child) after being forwarded through the donor CMP (or Split-CMP-Parent of the donor Split-CMP-Child).

B.4 Reporting

B.4.1 Home CMP (or Split-CMP-Parent) Receives Reporting Information from MCC

B.4.1.1 Short Description

The home CMP (Split-CMP-Parent) receives the tracking, logging, accounting and reporting data from the MCC.

B.4.1.2 Flow

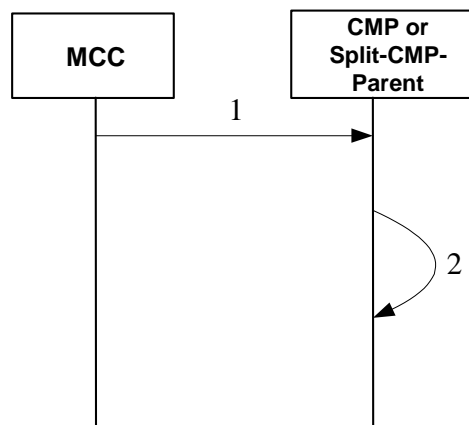


Figure 17: Example Flow - MCC Reports to Home CMP (or Split-CMP-Parent)

This call flow is based on either event-triggered or time-triggered scheduling.

1. The MCC reports tracking, logging, accounting and reporting data related to user actions on Mobile Codes and their resolved data to the home CMP (Split-CMP-Parent).
2. The home CMP (Split-CMP-Parent) receives, records and processes (e.g. for providing consolidated reports) the obtained tracking, accounting, logging and reporting data.

B.4.2 Home CMP (Split-CMP-Parent) Receives Reporting Information from MCC and Sends to Remote CMP (Split-CMP-Parent)

B.4.2.1 Short Description

The home CMP (Split-CMP-Parent) receives the tracking, logging, accounting, and reporting data from the MCC and forwards it to the resolving CMP (Split-CMP-Parent) of the resolving Split-CMP-Child.

B.4.2.2 Flow

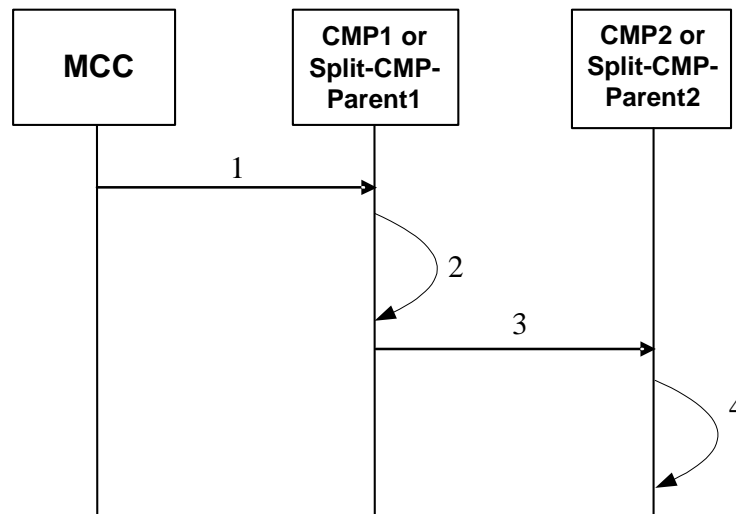


Figure 18: Example Flow - MCC Reports to Home CMP (or Split-CMP-Parent), Which Sends the Report to Remote CMP (Split-CMP-Parent)

This call flow is based on either event-triggered or time-triggered scheduling:

1. The MCC reports tracking, logging, accounting and reporting data related to user actions on Mobile Codes and their resolved data to CMP1 (or Split-CMP-Parent1).
2. CMP1 (Split-CMP-Parent1) receives the tracking, logging, accounting and reporting data and may record and/or process (e.g. for providing consolidated reports) the obtained data.
3. CMP1 (or Split-CMP-Parent1) forwards the tracking, logging, accounting and reporting data to the resolving CMP2 or Split-CMP-Parent2 of the resolving Split-CMP-Child. The time at which CMP1 (Split-CMP-Parent1) forwards the data may be determined by a timer or a policy.
4. CMP2 (Split-CMP-Parent2) receives, records and processes (e.g. for providing consolidated reports) the obtained tracking, logging, accounting and reporting data.

Appendix C. Deployment Scenario of the MCR (Informative)

Definition of the MCR component has been significantly motivated by an earlier concept of a global mobile code registry.

Global Mobile Code Registry (GMCR) refers to a service concept of a single entity entrusted by a pertinent global industry association (such as, the GSM Association, GS1, etc. with presumed endorsement by the majority of stakeholders in the nascent Indirect Code ecosystem) to perform mobile code registry services with a global scope. This GMCR service entity was envisioned to offer commercial grade, SLA-backed services including administering the assignment of Routing Prefixes, ensuring their global uniqueness and providing data look-up for discovery of assigned Routing Prefixes. Due to circumstances beyond the control of potential players as mentioned, the GMCR service concept has not materialised. However, depending on the growth rate of the mobile code ecosystem, this concept could potentially become relevant again in future.

Within the MC Enabler, given the normative definition of the MCR component (albeit optional), it is arguable that critical elements of the original (albeit non-implemented) GMCR service concept are being realised with the deployment of the following:

- A single root-level Routing Prefix registry administrator on a global basis – to be fulfilled by the OMA OMNA that assigns individual or ranges of Routing Prefixes (details of which will be specified in the TS). However, OMNA does not support any data look-up facility for discovery of unknown owners of assigned Routing Prefixes.
- Multiple Mobile Code Registries (MCRs) – a collection of local registries driven by stakeholders to promote Mobile Code usage within communities according to geographic or market boundaries. The primary responsibilities of the MCR complement that of the OMNA well, in that the MCR supports granular level of Routing Prefix assignments with a higher degree of scalability (by sub-allocating Routing Prefixes based on its acquired ranges of prefixes from OMNA), and also provides a data look-up facility accessible by authorised principals (e.g. CMPs or Split-CMP-Parents) for Routing Prefixes in its database. [For details of MCR functions, see 5.3.2]

Interconnection between MCRs and any required database synchronisation thereof are subject to business relationships, details of which are out-of-scope of the MC Enabler.